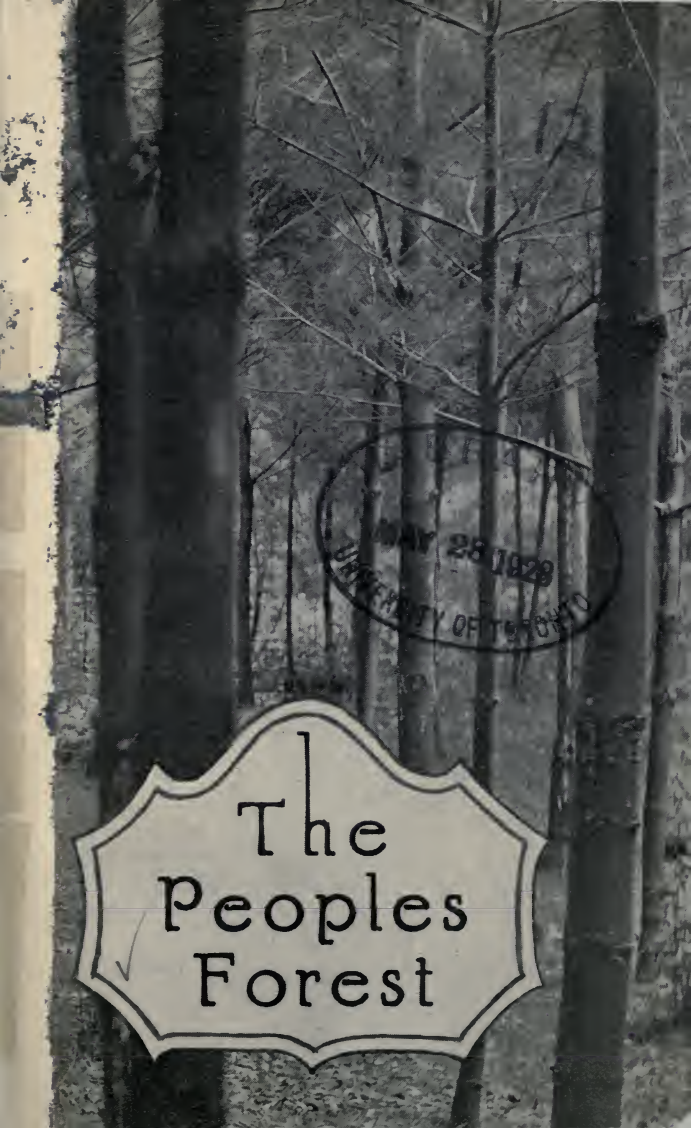


# The Peoples Forest

# THE PEOPLES STATE FOREST

## Typical of the Second Growth Forests of Connecticut

By AUSTIN F. HAWES, *State Forester*


COLEBROOK
HARTLAND
TO HARTLAND
RIVER
RIVERTON
PEOPLES
FOREST
BARKHAMSTED LIGHTHOUSE
FARMINGTON
WINSTED
BARKHAMSTED
PLEASANT VALLEY
WEST
TO BARKHAMSTED CENTER
FARMINGTON POND
½ MILE SCALE
NEW HARTFORD
NEW HARTFO

# INTRODUCTION

## LOCATION

THE PEOPLES FOREST is located in the town of Barkhamsted on the ridge east of the west branch of the Farmington River between Riverton and Pleasant Valley. It owes its name to the fact that it has been entirely given to the State through private subscriptions made to the Connecticut Forestry Association and gifts of land direct to the State.

This forest is surrounded by country roads and may be easily reached from Riverton or Pleasant Valley.

## LOCAL HISTORY

"The Barkhamsted lighthouse" far from navigable water is said to derive its name from the fact that the stage driver of early days, when settlements were far apart, would cheer his passengers by pointing to the light from these cabins and facetiously calling it the lighthouse. The remains of the old road may still be seen just above the present road. Closely associated with this settlement is the well known story of Molly Barber. She was brought up in Wethersfield, but after being thwarted in love by her father, made the boast that she would marry the first man who proposed whether he were white, red or black. This spirit of independence apparently appealed to the Indian Chaugham, for they eloped and founded this settlement in what

INDIAN GRAVE OVERGROWN WITH TREES AND LAUREL, "BARKHAMSTED LIGHTHOUSE"

was then a remote region. For many years it was a well known and perhaps rather notorious place, but the cabins fell to pieces long ago and trees are now growing in the cellar holes. Of this settlement now contained in this forest and properly marked the historian Barber says:

"A little more than a mile south of this place (Hitchcockville now Riverton) a few of the last remnants of the Narragansett Indians have a location, they came here about the year 1779 and purchased about 200 or more acres of land. Their houses or rather cabins are along side of the road, there are about 20 souls that make their constant residence here, though at times they number as many as 30 persons."[1]

The cellar holes and beds of lilies, and nearby graves may still be seen. At the time of the pageant dedicating this forest in 1924 a woman of the neighborhood and her two children attended, who showed plainly the Indian features inherited from these Narragansetts.

## DISTRIBUTION OF LAND AND SURVEYS

The beginning of distribution of land in Barkhamsted dates back to 1732. On September 7th of that year the proprietors of Windsor called a meeting to decide what should be done with the "Western Lands" so-called, of Barkhamsted, then in Hartford County. The meeting was adjourned until the first Monday in January, 1733.

[1] Connecticut Historical Collections by John Warner Barber, New Haven, 1836.

At the January meeting it was voted to divide the land among the proprietors at Windsor, giving each proprietor one acre of land for each pound of money he had on the lists.

A committee was appointed to have the land surveyed and laid out according to the vote. This first committee consisted of the following: Jonathan Stiles, William Stoughton, Pelatiah Allen, Samuel Grant, John Palmer, Benjamin Griswold, John W. Strong and Henry Allen. The first division of lots was laid out and surveys completed by Nov. 20, 1734.

The first survey lines were the Proprietors' Highways, ten rods wide, which were run N. 20° 20′ E. from the New Hartford town line. The first of these was located between the two branches of the Farmington River. The highways were a half mile apart. Lots were laid out by running lines from highway to highway at right angles to them, so most of the original lots were rectangular in shape. The north and south highways were connected by cross highways four or six rods wide, with no definite distance between them. The lot corners were marked, usually, with a stone heap and initials chiseled in the top stone.

The second division of lots was surveyed and recorded by April 8, 1760. The last three divisions were surveyed later. The cost of the last three divisions was given as follows:

| | |
|---|---|
| Surveyor | £35-19- 7 |
| Committee man | £21- 6-10 |
| Committee man | £21-12- 2 |
| Committee man | £26-14- 2 |
| Chainman | £ 2- 1- 7 |

Records show that all the land in Barkhamsted was not disposed of by laying out lots to each man, for later some of it was sold at auction. The last date on which a proprietor's meeting was held for the disposition of land, etc., was as late as 1823.

The earliest timber sale on land now in the purchase area of the Peoples Forest was more than a decade before the Revolution. On the second Tuesday in April, 1760, a committee of three was appointed to sell the timber on the highways to help defray the expense of surveying.

At a later date another committee was appointed to sell at public auction as much of the undivided land as would be necessary to pay costs of surveying the last three divisions and the "Cost of a Record Book for the Proprietors." At this sale the land was sold in fifty acre lots; the average price was £13-2-0 for the fifty acres.

After nearly two hundred years some of the old highway lines have been rerun on the Peoples Forest area. Many of the old bounds which were first put in about 1734 have been found intact. The stones are covered with moss and lichens, but by turning over the top stone the old initials will be found—the initials of the first white man who owned the land.

At present as we run over these lines, find the old moss covered bounds and read the initials, we wonder what difficulties our forefathers experienced in locating them as accurately as they did with their crude instruments, chaining up and down ledges and keeping line by compass, while today we use transit and stadia—but we

find the work was well done, their lines were straight although some of the distances were off a little.

## RECREATIONAL USE

Although surrounded by roads, the automobilist should not attempt the steep hill east of Riverton. Most people will enter the forest by the river road (east bank). Just south of an old barn on private property on the west of this road, a cart path leads to the river. Two stone fire places have been built here for public use and there is a third about one hundred yards farther south on the river bank.

From the "Lighthouse" a trail leads up through a beautiful ravine to the summit of the cliff overlooking the valley. This trail, constructed and well marked by Mr. Herbert Warner of Hartford, has two or three splendid outlooks, and leads over the mountain to a large spring and another fire place, and thence to the road on the east side of the forest. Another trail connects with an old wood road down the west side to the lower end of Riverton village.

Picnicing on the forest is permitted at all times. A general permit for camp fires is posted at the fire places. At other places and at times not covered by these permits, a special permit from the local fire warden is required. His address is "Clinton LeGeyt, Barkhamsted, Conn., Tel. Winsted 277-4."

## PAST TREATMENT

As shown by the age of the trees, most of this forest was cut clean, so far as the hardwoods

A Popular Camp Site on the Farmington, Peoples Forest

were concerned, between 1850 and 1890. While considerable amounts of lumber and ties were doubtless cut, much of the woodland here as elsewhere in Connecticut was managed on a short rotation for cordwood production so long as charcoal was required for the iron industry, and chestnut wood for the brass industry. Old charcoal circles still bear evidence that much "coal" was made here. There has been little clean cutting during the past thirty or forty years. Since the death of the chestnut most of the trees suitable for poles or ties have been cut and doubtless other large trees have been culled for lumber, but little cordwood has been cut. Since the acquisition by the State an attempt has been made to salvage the remaining chestnut either as ties, fence posts or fence rails. Considerable quantities of posts and rails especially have been sold.

This forest is a portion of the region known in old times as the "Greenwoods" because of the large amount of hemlock and pine in mixture. Of this Barkhamsted section the historian Barber[1] says in 1836: "The mountains and hills were formerly covered with excellent timber consisting of oak, chestnut, sugar maple, beech, pine and hemlock; a considerable proportion of which has been destroyed by wind and fire, and by the axe, under a system of improvidence, at a time when timber was considered of no value." It is, therefore, probable that most of the virgin timber, except on the steepest slopes had been cut before the Civil War. The Hitchcock Chair

[1] Connecticut Historical Collections by John Warner Barber, New Haven, 1836.

Works located at what is now Riverton doubtless used a considerable quantity of the lumber originally grown on this forest.

## PART I

## FOREST DESCRIPTION

This area of 1214[1] acres is sufficiently large to manage as a unit, although not large enough to justify the full time employment of a forester. Since it is fairly typical of much of the woodland of the state, this analysis is printed with the hope that it may have suggestions of value to the owners of similar property. If anything, the character of the forest is better than most tracts of this size for the reason that there have been no fires on it during the past fifteen or twenty years, and no land has been cut clean during that period. Like most of Litchfield County much of this land was cut over for cordwood and charcoal production in the old days when the iron industry of Connecticut was prosperous and used a great deal of charcoal and when large amounts of cordwood were used by the brass industry of the Naugatuck Valley. The occurrence in the forest of considerable old pine and hemlock is due partly to its inaccessibility and partly to the fact that these trees were seldom used for charcoal.

[1] Deed area 1241 acres.

TABLE NO. 1—*Classification of Land Area*

| Name of Type | Area acres | Per cent. |
|---|---|---|
| 1. Softwoods-Hardwoods | 166 | 14 |
| 2. Mixed Hardwoods | 457 | 38 |
| 3. Oak Ridge | 429 | 35 |
| 4. Old Field | 59 | 5 |
| 5. Swamp | 42 | 4 |
| 6. Forest Plantations | 26 | 2 |
| 7. Miscellaneous[1] | 35 | 2 |
| | 1,214 | 100 |

[1] Miscellaneous types include brush land covered with alder, etc., ponds, cliffs and small pieces of pasture.

In the softwood-hardwood type at least 80% of the trees are softwoods, hemlock and white pine. Hardwoods such as chestnut, oak, maple, red and white oak, gray birch, beech, tulip and basswood are mixed with the softwoods.

The mixed hardwood type has occasional specimens of hemlock and pine, but is mostly hardwoods of the foregoing species with black and scarlet oak added.

In the Oak Ridge type the chestnut oak predominates with considerable black and scarlet oak and a scattering of the other species.

The Old Field type is a scattering growth of gray birch, soft maple, with occasional white pine, hickory, ash and poplar. These trees have come in gradually during the past thirty years since the land was abandoned for farming.

In the swamp type soft maple, yellow birch, white ash and hemlock are the important trees with occasional elm and poplar.

As may be judged from Table 1, the larger part of this forest occupies land too rough for cultivation even in the days of greatest agricultural expansion. Adding the 35 acres in miscellaneous types, 26 acres of pine plantations, 59 acres of old fields, gives a total of 120 acres as the area which has at one time or another been used for farming. In other words not over 10% of the area has ever been farmed.

## INVENTORY OF FOREST

In the summer of 1926 a type map and estimate of the tract was made after the completion of the boundary survey. Parallel courses were run across the area from east to west and 69 carefully selected plots were laid out. All of the trees five inches and over on these plots which aggregated 30 acres were measured and

TABLE NO. 2—*Inventory by Types*

| Name of Type | Contents in Board Feet | Additional Contents in Cords |
|---|---|---|
| Softwood-Hardwood | 920,860 | 1,221 |
| Mixed Hardwoods | 932,570 | 5,883 |
| Oak Ridge | 747,483 | 4,112 |
| Old Field | 9,134 | 272 |
| Swamp | 13,593 | 201 |
| | 2,623,640 | 11,689 |
| Deducting 10% for defects and rounding off | 263,640 | |
| Total Board Feet | 2,360,000 | |
| Adding the equivalent in cords | | 524 |
| Total additional cords | | 12,213 |

the inventory of the whole forest was computed from these. Trees eight inches and over in diameter of all valuable species were computed in board feet and the smaller trees in cords. All birches, maple, poplar, etc., were computed entirely in cords.

The average stand for the whole area is therefore 1,945 board feet and 10 cords per acre. If only the wooded area, 1,153 acres, is considered, the average stand per acre is 2,050 board feet and 10½ cords.

For purposes of estimating, 1,000 board feet are equivalent to two cords. The 2,360,000 board feet are equivalent to 4,720 cords. This table does not include dead chestnut or other dead trees. Neither does it include the cordwood in trees under five inches in diameter nor the tops of trees estimated in board feet. There are approximately 4,500 chestnut ties and a large number of fence posts on the area, so it is safe to estimate an additional 2,000 cords to cover these items, making a total of practically 19,000 cords.

In other words about 25 % of the total stand is suitable for lumber and 75% is at present fit only for cordwood. In computing trees down to eight inches in board feet, there is, of course, no thought that good trees of that size would be cut. It simply indicates what is marketable according to Connecticut saw mill practice. Some of the material is also too inaccessible to be cut either for lumber or wood. This percentage is a very good criterion of the kind of management a forest has had in the past. In Europe where

market conditions make possible a much more complete utilization, great stress is laid on it. In the communal forests of Baden before the war, for example, an average of 50% of the volume was merchantable for high-grade material, while in the state forests the average was 55%. In some of the spruce and fir forests this figure ran as high as 75 to 78%. The fact that softwood trees yield a considerably higher percentage of high-grade material is one of the reasons that softwoods are more profitable than hardwoods. Results like the above can only be obtained by good management over a long series of years.

## KIND OF MATERIAL

The stand of lumber may be classified approximately as follows:

| | Board Feet |
|---|---|
| Softwoods: Hemlock and White Pine | 553,000 |
| Hardwoods; Oak and other species | 1,807,000 |
| | 2,360,000 |

That most of the lumber would be of small sizes is indicated by the following classification of the trees by diameters:

| | |
|---|---|
| Trees 5" to 7" (cordwood size) | 65% |
| Trees 8" to 11" (small lumber) | 28% |
| Trees 12" and over (lumber of average size) | 7% |
| | 100% |

This table shows that three-fourths of the wooded area has a growth between 40 and 80 years of age, and that on three-fifths of the area the growth is between 40 and 60 years. In other

On the Rocky Slopes Many Trees Have Escaped Cutting
White Pine 20 Inches in Diameter Containing 500 Board Feet

TABLE No. 3—*Inventory by Age*

| Age in Years | Number of Acres | Percent of Total Area | Board Feet | Percent of Total Board Feet |
|---|---|---|---|---|
| 1 to 20 | 149.8 | 12 | ---- | ---- |
| 21 to 40 | 142.5 | 12 | 80,000 | 3 |
| 41 to 60 | 704.2 | 58 | 1,290,000 | 54 |
| 61 to 80 | 160.5 | 13 | 590,000 | 25 |
| 81 to 100 | 11.5 | 1 | 110,000 | 6 |
| 101 and over | 45.5 | 4 | 290,000 | 12 |
| | 1214. | 100 | 2,360,000 | 100 |

words there has been no appreciable clean cutting during the past twenty years and none of any extent for forty years—since the charcoal market disappeared. Most of the land was cut over, so far as hardwood is concerned, between 1850 and 1890, but about 6% of the area has a growth over 80 years of age. Most of the trees 12" and over in diameter are doubtless on these portions, which are naturally the most inaccessible steep slopes.

Practically no lumber has been produced in this forest in less than forty years. Over half of the lumber is between 40 and 60 years; one-quarter between 60 and 80 years, although only one-eighth of the area is in this age class. The age classes above 80 years produce 18% of the lumber, although they cover only 6% of the area.

## GROWTH OF FOREST

A growth analysis of 1,001 acres of wooded land having a forest 20 years or more old is given in Table No. 4.

TABLE No. 4—*Growth of Forest in Cords*

| | Area Acres | Per Cent of Total Area | Annual Growth per Acre Cords | Total Growth Cords |
|---|---|---|---|---|
| Quality I | 384.3 | 38 | .39 | 148.3 |
| Quality II | 296.1 | 30 | .28 | 82.4 |
| Quality III | 320.8 | 32 | .20 | 66.1 |
| | 1001.2 | 100 | | 296.8 |

These figures are secured by dividing the total inventory of each quality class by the age. The area is divided about evenly between the best site (Quality I, 38%), the poorest site (Quality III, 32%) and the medium site (Quality II, 30%). The average growth on the poorest land, the top of the ridge, has been one-fifth of a cord, and on the best soils two-fifths of a cord. This growth even on the best sites is low because of the loss of the chestnut. If the growth had been studied twenty years ago, before the appearance of the chestnut disease, it would undoubtedly have been much greater, for it was not uncommon in those days for our forests to grow one cord per acre per annum. These growth figures conform fairly well with similar studies in Penn.[1] where pure stands of chestnut formerly produced a cord to the acre a year. It was found that white and chestnut oaks will produce only 30 to 40 per cent as much, while scarlet and red oaks will produce 50 to 60 per cent as much. Replacing chestnut with oaks therefore reduces the productivity of the forest about 50% so far as

[1] Problems arising from the loss of our Chestnut, Forest Leaves, 17-153-155. E. A. Ziegler.

volume is concerned. Only 40 acres were found in the Peoples Forest having a density of 70% or more. These areas had 345 trees per acre 5″ and over in diameter. In other words most of the forest has less than 60% of the number of trees which the land could support—an average of 180 trees 5″ and over per acre. Of course in all stands under 40 years of age there are a good many trees under 5.″ A study of the oak type in Connecticut made some years ago[1] showed that at age 40 the number of trees per acre vary in fully stocked stands from 400 to 650 according to the soil. There are always fewer trees of a given age on the best soils because the growth there is faster and the competition there has been keener. Even at the age of 70 years, the number varies from 220 to 275 per acre. Similar studies made in Connecticut hemlock stands[2] showed that the number of trees per acre should vary from 830 to 1,525 at age 40; and from 230 to 525 at age 70.

It must be borne in mind that the growth figures given above are for the whole life of the forest. No studies of the present rate of growth were made, but it is probable that the thinning resulting from the death of the chestnut is producing a better growth at present. These growth figures should not be taken as indicative of the growth of the forest in the future under proper management, since the growth can be further

[1] Second Growth Hardwoods in Connecticut by E. H. Frothingham, Bul. 96, Forest Service, U. S. Dept. Agr. 1912.

[2] Hemlock—Its place in the Silviculture of the Southern New England Forest, by P. H. Merrill and R. C. Hawley, Yale Univ. School of Forestry Bul. 12, 1924.

increased by proper thinnings and filling in unproductive portions.

This difference between mean annual growth (for whole life of forest) and periodic growth (for short period) is plainly shown in a study made in spruce and balsam in Northern New England by the Northeastern Forest Experiment Station.[1] For the first 55 years of the life of such a forest the mean annual growth varies from .44 to .93 cords per acre according to the site; while for the decade just prior to age 50 the growth was from 1.26 to 2.76 cords. In other words the growth during this decade was about three times as much as for the whole life of the forest.

## REPRODUCTION

The character of the future forest is dependent upon the young growth, or reproduction, as it is called. In general the reproduction in this forest is satisfactory because it has been free from fire.

In the white pine stands which have usually come in on abandoned farm land, there is successful reproduction of white pine, with sprouts of oak and red maple.

In the hemlock stands there is reproduction of pine, hemlock, chestnut oak and red maple with occasional seedlings of birch and tulip.

In the mixed hardwood type there is satisfactory reproduction of red and chestnut oak, hickory, basswood, ash, beech, maple and birch. In the vicinity of pine and hemlock there is also considerable reproduction of these species.

[1] Investigative Program 1927.

In the oak ridge type the reproduction of chestnut oak is good with occasional seedlings of hickory and maple.

## PART II

## MANAGEMENT—THE IDEAL—PURPOSE OF MANAGEMENT

In the management of any forest it is well to have a fairly well defined ideal toward which to work even though conditions may prevent the actual attainment of the ideal. The purpose of management of this forest may be summarized as follows:

a. To produce large timber for Connecticut industries.
b. To yield a revenue to the State.
c. To protect the water supplies.
d. To protect the wild life.
e. To furnish a recreational area.

With these various objects in mind, the plan of management is somewhat more complicated than would be the case if there were only one of the above purposes to consider. Handling a forest for the greatest revenue, for example, is not always consistent with leaving trees to produce large timber. The recreational use of the tract makes it desirable in sections along roads and trails to protect such flowering trees and shrubs as dogwood, shadbush and laurel, which have no commercial value. From the standpoint of bird cover also it is desirable to protect shrubs

having berries which are favorite foods for birds as well as old apple trees. Brooks should be kept well shaded, as low water temperature is essential for brook trout.

Having all these subjects in mind, certain general principles of management can be laid down, as follows:

a. Thorough protection must be provided against fire, insects and disease.
b. No land will be cut clear unless to salvage material injured by fire, ice storms or other agencies.
c. The management will aim to increase the proportion of such valuable trees as pine, hemlock, white and red oak, white ash and tulip.
d. The growing capital of the forest should be allowed to accumulate. For this reason the amount of live material cut in any year will be kept well below the annual growth—300 cords or its equivalent in lumber, ties, etc.
e. The forest will be open to the public, and kept, so far as possible, in a natural condition. Camp fires must be confined to well constructed fire places.

## ROTATION

By rotation is understood that period of years which elapses between the formation of a forest, whether by planting or natural reproduction, and the time when it is finally cut over and regenerated. This period naturally varies with the conditions of soil, kind of trees, products desired and purpose of management. It is quite probable

An Unspoiled Roadside

that any rotation decided upon at this time will be changed in a revision of the plan in later years.

While there are certain types such as the old field type of gray birch and red maple which become mature at an early age and should be replaced, it is thought best for the purpose of simplicity to handle the whole forest under a rotation of 100 years. If we exclude 24 acres as blanks, including the brooks, roads, and small areas of brush land, we may consider the productive area of 1,200 acres. Under an ideal arrangement a "normal" forest of this area should have an equal distribution of age classes as follows:

| | | |
|---|---|---|
| Class I | 1 to 20 years | 240 acres |
| Class II | 21 to 40 years | 240 acres |
| Class III | 41 to 60 years | 240 acres |
| Class IV | 61 to 80 years | 240 acres |
| Class V | 81 to 100 years | 240 acres |

Referring back to the present inventory by age classes, it is evident that the third age class has nearly three times as much area as it should have, while all other classes are deficient. It will be desirable to cut over as soon as practicable the area over 100 years of age in order to get this portion into a more productive condition and thereby increase the area of the first age class. The difficulty is that the oldest stands are the most inaccessible. By planting the open areas and gradually reproducing the least productive areas of the third age class, a more ideal arrangement of age classes can be affected.

Yield tables already constructed indicate what fully stocked forests with types similar to those

in the Peoples Forest should yield at different ages.

TABLE NO. 5—*Yields of Fully Stocked Stands, Connecticut Forest Types Similar to Peoples Forest at 50 and 70 Years.*

| Type | Age 50 Board Feet | Cords | Age 70 Board Feet | Cords |
|---|---|---|---|---|
| 1. Hemlock | 10,000 | 21.8 | 18,500 | 36 |
| 2. Oak | 5,000[1] | 38. | 9,250[1] | 47 |
| 3. White Pine | 36,000 | 70. | 57,400 | 103 |
| 4. Pine and Hemlock | 9,090 | 18. | 19,305 | 34 |

[1] Estimated on basis that Oak produces 50% as much lumber as Hemlock.

Applying these yields at 50 yrs. which should be the average age in a forest managed on a rotation of 100 years we may obtain the results shown in Table No. 6.

TABLE NO. 6—*Comparison of Possible with Actual Yield of Peoples Forest at Age 50 Yrs. or Average for 100 Yr. Rotation.*[2]

| Type | Approximate Area Acres | Possible Yield in Board Feet | Actual Yield |
|---|---|---|---|
| Softwoods-Hardwoods | 166 | 1,494,000 | |
| Pine | 47 | 1,692,000 | |
| Hardwoods | 987 | 4,935,000 | |
| Total Productive Area | 1,200 | 8,121,000 | 2,360,000 |

[2] If yield tables were available it would be better to take yields at 100 years and divide by 2.

In other words the present stand of lumber is about 30% of what a forest with these types should have if properly managed on a rotation of 100 years.

## PROTECTION

This forest is well protected from fire on the west by the Farmington River. This position, together with the fact that little clear cutting has been done, doubtless accounts for its recent immunity from fire compared to the hills west of the river which have been largely cut clear and burned during the past decade. Since no clear cutting is to be practiced on the state forest, the hazard from slash will be eliminated except on adjoining private areas. No woods operations and no camp fires will be allowed during April and the first half of May. Four stone fireplaces have been constructed for campers so that there will be plenty of opportunity for camp fires in safe periods. The danger from picnic parties may, however, increase as the forest is used more for recreational purposes. The old wood roads will be kept clean, thus opening up the area for recreational use and making the sections readily accessible to fire fighters. Experience indicates that it costs from $25.00 to $50.00 a mile to clean these roads depending upon the amount of laurel in them. A supply of equipment consisting of one double forester pump, one single forester pump, six pails, six shovels and one axe will be kept at the forest for use at fires. Special trucks with extra equipment are available at Simsbury and Mohawk as well as at the headquarters of various fire fighters. Water

holes will be provided, and designated with signs. wherever practicable to supply water for the pumps. Investigations have shown that it requires 15 years or more for pine slash to entirely disappear. So far as possible, therefore, pine tops will be burned.

Areas with good stands of white pine will be carefully scouted for ribes and all bushes destroyed to protect the pine from blister rust.

## SILVICULTURAL PRACTICE

Much that is desirable to bring about improved conditions in our forests has to be omitted because of the meagre market for the inferior material. Under this heading we will mention a few of the desirable operations.

## PLANTING

The common conception of the state forests is that they are large areas requiring planting. As a matter of fact this forest illustrates very well the fallacy of such an idea. Practically all the land at present suitable for planting, 26 acres, has already been planted. Heavy cuttings should be made in the old field type, 59 acres, and considerable planting will be required to fill in the blanks. For the most part the forest will be reproduced through natural seeding which is much cheaper.

## CUTTINGS

The layman usually speaks of all cuttings as thinnings. The forester, however, distinguishes several kinds of cuttings depending upon the purpose. In this study we shall consider three kinds.

## SALVAGE CUTTINGS

As the name implies, these cuttings are made simply to salvage material which would otherwise go to waste. The only cuttings made since State acquisition have been of this nature. Over 6,000 fence posts and 4,000 fence rails have been sold from the dead chestnut and a contract has been made for the remaining ties. Permits are given to local people to cut ten cords of dead wood, under the direction of the district forester, for family use, but there have been few applications since most people of the neighborhood own their own woods.

## IMPROVEMENT THINNINGS

In many parts of this forest there are clumps of pine or hemlock seedlings which are being seriously damaged by gray birch, soft maple and other inferior hardwoods of approximately the same age. These weed trees should be cut off during the summer months when they are less likely to resprout. They can be cut while small with a brush hook or machete at slight cost. A thinning of this kind to regulate the mixture in the future forest is called a weeding or cleaning. Similar weedings may be made in young hardwoods to increase the proportion of valuable species. Such weedings are made before the material cut is of any value and are therefore somewhat different from improvement thinnings proper which yield low grade material and hence some income.

The Society of American Foresters[1] has recognized three forms of tree growth:

1. "A sprout is a tree which has grown from a stump or root. (A sucker is a tree growing from a root.)" Beech and Aspen are the only trees which sprout from roots in this vicinity.
2. "A seedling is a tree grown from seed."
3. "A seedling sprout is a sprout resulting from the cutting of a seedling or small sapling. This is differentiated from coppice sprout or shoot because of its subsequent behavior." Seedling sprouts also occur from seedlings killed back by fire and other causes just as sprouts grow from stumps of trees killed by fire, the chestnut disease, etc.

Of these three forms the sprout is the poorest for timber production because the portions of the old root system which are not used by the sprout soon decay and carry the decay back into the heart of the new tree. This accounts for the decay which is characteristically found in the butts of sprout trees. In the days when a high yield of cordwood was desired for the iron, brass and brick industries a short rotation of sprouts was most profitable. Now that high grade timber is desired, the sprout is the least desirable form to perpetuate to old age.

Seedling sprouts use the root system of the previous generation in its entirety. Thus the seedling sprout approaches the true seedling in

[1] Yale Univ. School of Forestry Bul. No. 15 by Leffelman & Hawley.

freedom from butt rot. These seedling sprouts may occur singly or in clumps. P. L. Buttrick writing on forest fires[1] in Connecticut says: "It is the writer's observation that fully half the seedling reproduction consists of seedling sprouts."

A careful study[2] of the reproduction of southern Connecticut showed that 92 per cent of the oaks and 87 per cent of the other hardwoods are of the better growth forms, i.e. seedlings and seedling sprouts. The proportion of seedlings decreases on the poorer sites and that of seedling sprouts increases.

Height growth is the factor determining the final predominance of trees in a forest where the young growth has a large mixture of species. Of the common Connecticut hardwoods, red oak, chestnut oak, and red maple are the three fastest growing species. Hickory, black oak and scarlet oak grow at a somewhat slower pace, while white oak is the slowest of the important species. As the forest matures there is little difference in height growth between seedlings, seedling sprouts and sprouts. In other words the rate of height growth for a given species does not vary with the growth form.

While conditions in the Peoples Forest are somewhat different from those where this study was made (New Haven County) because of the presence of pine and hemlock, the main principles are doubtless the same. Table No. 7 is, therefore, of interest.

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[1] Forestry Quarterly Vol. 5, 1907, page 134.
[2] Yale University School of Forestry, Bulletin No. 15, Leffelman and Hawley.

On the Trail to the Summit

TABLE NO. 7—*Showing Percentage of Area on Each Site Occupied by Well-Formed, Free Seedlings, and Seedling Sprouts of Oak, and by Other Classes of Stems in Stands More Than Fifty Years of Age*

| | Site I | Site II | Site III |
|---|---|---|---|
| | Percentage of Total Area | | |
| Oaks, well-formed, free seedlings and seedling sprouts | 50 | 55 | 55 |
| Other Hardwoods, well-formed free seedlings and seedling sprouts | 15 | 10 | 5 |
| Sprouts, all species, and poorly formed seedlings and seedling sprouts | 35 | 35 | 40 |
| Woody Shrubs | 0 | 0 | 0 |
| Total | 100 | 100 | 100 |

"Summed up for all sites, the future stand will be fully stocked, even-aged, with at least one-half the area occupied by oak of the better growth forms, principally seedling sprouts. The remaining one-half of the area, although in the possession of other species than oak, will contain many individuals of equal value with the oak of better growth form."

A similar study made by another forester[1] in Connecticut showed that fully half of the new reproduction is of desirable species, and that fully 65% of the individuals of these species are of seedling origin.

As already mentioned the number of trees in the Peoples Forest has been so diminished by the

[1] U. S. Dept. of Agr. Miscellaneous Circular 100.

chestnut blight that there is not a crying need for thinnings on an extensive scale. The U. S. Forest Service has studied this question of stimulation of growth of the remaining species after the death of the chestnut.[1] In 134 trees of different varieties of oak examined it was found that there was an average acceleration in the rate of growth ranging from 26% in the white oak to 63% in red oak. Chestnut oak showed an average increase of 48% and scarlet oak of 38%. These are increases over the growth during the decade before the chestnut died. In spite of this natural thinning there are, in this forest, clumps of trees, in some cases an acre or more in extent, which are too crowded to make the best development. Wherever in such clumps trees can be marketed for cordwood without involving a financial loss, a thinning should be made in stands between thirty and fifty years of age. All trees to be cut will be marked by a forester. Dominant trees of inferior species such as poplar, red maple, gray birch, scarlet oak, and badly deformed or decayed specimens of any species should be taken out in the first thinning. In the second thinning which may be made 10 or 15 years after the first thinning more attention can be given to the growth form, eliminating most of the sprouts, thus leaving a stand of seedlings and seedling sprouts of the valuable varieties to develop large timber. The forest of the future, 60 to 100 years old, will therefore be made up chiefly of red, white, chestnut and black oaks, white ash, tulip, basswood, white pine and hemlock.

[1] The Natural Replacement of Blight-Killed Chestnut—Miscellaneous Circulars No. 100 (U. S. Dept. of Agr.) By C. F. Korstian.

The purpose of the thinnings is not only to secure a mixture of valuable and healthy specimens but to secure increased growth through the added soil moisture available to their roots and sunlight available to their crowns. After the first thinning all subsequent thinnings would yield a profit because there will be other products besides cordwood. In the most highly developed forestry practice a considerable proportion of the total growth of a forest is removed from time to time in the form of thinnings. This is in marked contrast to prevailing practice in this country where all material is removed in one final cutting. Care must be taken not to open up the forest by such thinnings to such an extent as to produce an advanced growth of young trees and shrubbery.

Experiments[1] in thinning white pine stands over a period of 20 years, beginning when the forest was 35 years old, have brought out some very interesting facts. In a plot which was rather heavily thinned four times, 81% of the original trees were removed during the period, while in an unthinned check plot 32% of the trees died from natural causes. At the beginning of the experiment in 1905 the stand per acre in each case was about 14,500 board feet. In all 15,294 board feet per acre were removed from the thinned plot and the stand at the end of the period was 17,562 board feet so that the yield at age 55 yrs. was 32,856 board feet. In the unthinned plot the stand at age 55 yrs. was 30,520 board feet. The growth during the 20 year period was therefore 18,192 board feet in the

[1] The Results Secured in Treating Pure White Pine Stands by R. C. Hawley—Yale Univ. School of Forestry—Bul. No. 20.

thinned and 16,264 feet in the unthinned plot. More striking is the growth at different periods. The average growth per acre for the first 35 years was 410 board feet per acre. During the first five years of the experiment the unthinned plot grew more than the thinned plot, 996 board feet per year as against 857 board feet. But in the last five years the growth of the thinned plot was 1241 board feet and of the unthinned plot 1086 board feet. Evidently the effects of thinning are cumulative. Height growth as volume growth was stimulated.

Another factor in thinning is that the capital invested in wood is smaller in the thinned forest and the interest earned greater even if the rate of growth were no more. Thus in the thinned plot described above the growth during the past five years was at the rate of 39% on the invested capital or at the average rate of 7.8% per year. In the unthinned forest it was 22% for five years or 4.5% per year. The early returns from thinnings, where they can be sold at a profit, reduce the cost of raising a crop of timber.

## REPRODUCTION CUTTINGS

As pointed out elsewhere, planting is of relatively little importance in this forest. By proper cutting the forest will reproduce itself. The forester's skill is required to so regulate this reproduction that the percentage of valuable species will be greater in the next generation. Following clear cutting the reverse is often the case. In the Yale study it was found that the number of trees and shrubs on an acre cut clear five years

previous to the study varied from 5,000 on the poorer sites to 16,000 on the best sites. The character of this young growth is indicated by Table No. 8.

TABLE NO. 8—*Showing the Amounts Expressed in Per Cent of the Total Number of Stems Formed by Oaks, Other Hardwoods*[1] *and Woody Shrubs on Sites I, II, and III*

| Species | Site I Per Cent. | Site II Per Cent. | Site III Per Cent. |
|---|---|---|---|
| Oaks | 24 | 46 | 59 |
| Other Hardwoods | 45 | 29 | 26 |
| Woody Shrubs | 31 | 25 | 15 |
| Total | 100 | 100 | 100 |

[1] All trees of the former generation had been removed.

It is evident from this table that the better the soil the greater is the percentage of species other than oak, including woody shrubs.

Special effort will be directed in this forest to securing an increased proportion of white pine, hemlock, white ash, tulip, red and white oak. Owing to the fact that small white pine cannot compete with a dense growth of hardwoods the opportunity for increasing the percentage of this species is limited to the more poorly stocked stands where there happen to be enough pine to leave for seed purposes. Large spreading topped trees produce the most seed and should be left until the ground is well seeded.

An example of prolific reproduction of white pine subsequent to thinning was brought out in

the Yale study.[1] On the heavily thinned plot there were in 1925 approximately 6,000 white pine seedlings as old as five years. In the unthinned plot of the same age there was not a single living pine seedling as old as five years.

The expense of converting hardwood forests to pine forests is too great to be practiced on a large scale, even if it were desirable. Since hemlock produces more lumber than oak in a given period a controlling object in the management of the Peoples Forest will be the gradual increase of hemlock in certain of the hardwood stands by natural means. Clear cutting and fire have combined to eliminate the hemlock from much Connecticut woodland where it grew originally. The comparative freedom from fire of the Peoples Forest is undoubtedly the reason for the presence of so much hemlock. The fact that hemlock was not desired for charcoal in the earlier cuttings also favored the reproduction of this species, for the presence of one to ten hemlock per acre has been found to be sufficient to produce a continuous understory beneath the next hardwood crop.[1] When this hardwood upper story is cut the understory of hemlock will develop into a pure hemlock forest. There are considerable areas in this forest which should be treated in this way. Hemlock has the ability to grow rapidly in diameter after long periods of suppression.[2] This is in marked contrast to the former theory that hemlock is naturally a slow growing tree. Fifty-nine trees which had required an average of 11

[1] Yale Univ. School of Forestry. Bul. No. 20. 1927.

[2] Yale Univ. School of Forestry, Bul. No. 12, Merrill & Hawley.

years to grow one inch in diameter before a liberation required only 4½ years to grow the same amount after the over story was removed. The problem of securing hemlock reproduction is a real one because conditions favorable for the germination of hemlock are equally favorable for black birch and similar hardwoods which grow faster and soon overtop the hemlock, thus producing another "two storied forest." Dense reproduction of hemlock occurs where the mineral soil is exposed. A moist bed of hardwood leaves also makes a good seed bed. A plot in an opening, caused by the removal of several large trees, examined by Merrill & Hawley, showed hemlock seedlings at the rate of over one million per acre together with hardwood seedlings at the rate of over one hundred thousand per acre. In the course of a few years the latter would completely overtop the former. Hemlock produces seed abundantly at two to three year intervals. If cuttings can be made not later than the spring following a seed year, chances for successful regeneration are increased. Grazing by cattle and horses tends to reduce the competition between the hardwoods and hemlock since the animals do not injure hemlock. If the hemlock once overtops the hardwoods a pure stand of hemlock is assured.

White ash and tulip reproduce best in fairly moist situations in small openings on mineral soils among ferns where there is not too much competition with red maple, the oaks and shrubbery.

With these various factors in mind, reproduction cuttings should be made during the next ten years in all stands 80 years or more in age, so

that by the time the final cutting is made at age 100 years the ground will be well covered with desirable reproduction. Since the purpose of a reproduction cutting is quite different from that of an improvement cutting, namely: 1. to secure a profit; and 2, to secure reproduction, trees are left in this case for seed purposes rather than for increased growth.

In closing this discussion of the plan of management of a typical second growth forest we wish to point out the present tendency among foresters toward mixed rather than pure forests. Soil authorities point out that a mixture of hardwood leaves with the evergreen needles is very valuable in enriching the soil, and the character of the timber raised in a mixed forest appears to be correspondingly better than in a forest of one kind of tree. No effort will be made therefore to secure pure stands except on limited areas.

White Pine Thinned and Pruned to Produce High Grade Lumber